

REMARKS

Claims 1-15, 17-20, 22-31, 33-39, and 42-55 are currently pending. Claims 1, 19, 25, and 33 have been amended, claims 16, 21, 32, and 40-41 have been cancelled, and new claims 42-55 have been added.

The Examiner rejected claims 1, 3-6, 12-13, 15, 17, 19-20, 25, 27-28, 33 and 36 under 35 U.S.C. §102(b) as being anticipated by Nozawa (Japanese Patent No. JP 06-038415).

Amended claim 1 defines a rotor assembly for an electric motor. The rotor assembly includes a spoke permanent magnet rotor having an axis of rotation and a single body of permanent magnet material that continuously circumferentially surrounds the axis of rotation and continuously radially extends outwardly relative to the axis of rotation to form a plurality of outwardly extending portions. The rotor assembly also includes ferro-magnetic material positioned adjacent to the outwardly extending portions of permanent magnet material. A shaft supports the spoke permanent magnet rotor for rotation about the axis of rotation.

Nozawa does not teach or suggest, among other things, a rotor that includes a single body of permanent magnet material that continuously circumferentially surrounds the axis of rotation and continuously radially extends outwardly relative to the axis of rotation to form a plurality of outwardly extending portions. Rather, Nozawa discloses a rotor construction that includes a plurality of permanent magnets 11 disposed between an inner cylinder 13 and an outer cylinder 12. Each permanent magnet is separate from the adjacent permanent magnets and extends only partially around the circumference. The Examiner points to the permanent magnet material 41 and 31b illustrated in Figs. 3 and 4 as extending circumferentially and surrounding the axis of rotation. However, as is clear in Figs. 3 and 4, there is a gap between

adjacent permanent magnets 31b and 41. As such, there is no continuous circumferentially surrounding portion of permanent magnet material.

In light of the foregoing, Nozawa does not teach or suggest each and every limitation of claim 1. As such, claim 1 is allowable. In addition, claims 2-18 and 42-45 depend from claim 1 and are allowable over Nozawa for these and other reasons.

Amended claim 19 defines a rotor assembly for an electric motor. The rotor assembly includes a permanent magnet rotor having an axis of rotation. The rotor assembly also includes a portion of permanent magnet material that substantially surrounds a portion of the axis of rotation and has a first magnitude of magnetization and a plurality of angularly spaced spoke portions of permanent magnet material extending outwardly from the portion of permanent magnet material and having a second magnitude of magnetization different from the first magnitude of magnetization. Ferro-magnetic material is positioned between the angularly spaced spoke portions of permanent magnet material. A shaft supports the permanent magnet rotor for rotation about the axis of rotation.

Nozawa does not teach or suggest, among other things, a rotor that includes a portion of permanent magnet material that substantially surrounds a portion of the axis of rotation and has a first magnitude of magnetization and a plurality of angularly spaced spoke portions of permanent magnet material extending outwardly from the portion of permanent magnet material and having a second magnitude of magnetization different from the first magnitude of magnetization. Rather, Nozawa discloses several constructions of a rotor that include permanent magnet portions 11 disposed between an inner cylinder 13 and an outer cylinder 12. Of these constructions, only the construction illustrated in Fig. 4 includes a portion of permanent magnet material that extends circumferentially around a portion of the axis of

rotation and a plurality of angularly spaced spoke portions of permanent magnet material. However, Nozawa makes no mention of magnetizing these two portions such that they have different magnitudes of magnetization.

In light of the foregoing, Nozawa does not teach or suggest each and every limitation of claim 19. As such, claim 19 is allowable. In addition, claims 20-24 and 46-48 depend from claim 19 and are allowable over Nozawa for these and other reasons.

Amended claim 25 defines a rotor assembly for an electric motor. The rotor assembly includes a spoke permanent magnet rotor having an axis of rotation. The rotor also includes permanent magnet material having a portion that substantially surrounds a portion of the axis of rotation and has a first magnitude of magnetization and portions extending outwardly relative to the axis of rotation to form a plurality of outwardly extending spoke portions of permanent magnet material having a second magnitude of magnetization different from the first magnitude of magnetization. The permanent magnet material includes permanent magnet powder compacted using an electromagnetic compaction process. Ferro-magnetic material is positioned adjacent to the outwardly extending spoke portions of permanent magnet material. A shaft supports the spoke permanent magnet rotor for rotation about the axis of rotation.

Nozawa does not teach or suggest, among other things, a rotor that includes permanent magnet material having a portion that substantially surrounds a portion of the axis of rotation and has a first magnitude of magnetization and portions extending outwardly relative to the axis of rotation to form a plurality of outwardly extending spoke portions of permanent magnet material having a second magnitude of magnetization different from the first magnitude of magnetization. Rather, Nozawa discloses several constructions of a rotor that include permanent magnet portions 11 disposed between an inner cylinder 13 and an outer

cylinder 12. While Fig. 4 of Nozawa does illustrate a permanent magnet having a circumferential portion and a radial portion, there is no mention of providing these two portions with magnitudes of magnetization that are different.

In light of the foregoing, Nozawa does not teach or suggest each and every limitation of claim 25. As such, claim 25 is allowable. In addition, claims 26-31 and 49-51 depend from claim 25 and are allowable over Nozawa for these and other reasons.

Amended claim 33 defines a rotor assembly for an electric motor. The assembly includes a spoke permanent magnet rotor having an axis of rotation. The assembly also includes permanent magnet material having a portion that continuously surrounds a portion of the axis of rotation and portions that extend outwardly relative to the axis of rotation to form a plurality of outwardly extending spoke portions of permanent magnet material. Ferromagnetic material forms a plurality of pole pieces. Each pole piece is positioned between a set of circumferentially adjacent outwardly extending spoke portions of permanent magnet material. The permanent magnet material includes injection molded plastic bonded permanent magnet material. A shaft supports the spoke permanent magnet rotor for rotation about the axis of rotation.

Nozawa does not teach or suggest, among other things, a rotor that includes a portion of permanent magnet material that continuously surrounds a portion of the axis of rotation. Rather, Nozawa discloses several constructions of a rotor that include permanent magnet portions 11 disposed between an inner cylinder 13 and an outer cylinder 12. Each permanent magnet is separate from the adjacent permanent magnet and extends partially around the circumference. Each example illustrated by Nozawa includes a gap between adjacent

magnets. As such, there is no disclosed construction in which the permanent magnet material continuously surrounds a portion of the axis of rotation.

In light of the foregoing, Nozawa does not teach or suggest each and every limitation of claim 33. As such, claim 33 is allowable. In addition, claims 34-39 and 52-55 depend from claim 33 and are allowable over Nozawa for these and other reasons.

The Examiner rejected claim 2 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Ferreira (U.S. Patent No. 5,204,572).

Claims 2 depends from claim 1 and adds that the outwardly extending portions of permanent magnet material extend radially outward to the perimeter of the spoke permanent magnet rotor.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1, much less those of claim 2.

Ferreira does not cure the deficiencies of Nozawa. Ferreira discloses a rotor that includes an iron core 16 positioned around a shaft 26. A series of trapezoidal permanent magnets 36 extend substantially radially from the iron core to a circumference. A plurality of interpole members are positioned between adjacent permanent magnets and extend to the circumference. Ferreira does not teach or suggest a permanent magnet portion that circumferentially surrounds the axis of rotation to form a continuous circumferentially surrounding portion of permanent magnet material *and* a plurality of outwardly extending portions of permanent magnet material. Rather, the permanent magnet portions are either separated and do not include a continuous portion that surrounds the axis of rotation, as in Figs. 3-5, or are circumferentially located as shown in Figs. 1 and 2. There is no teaching or suggestion that would lead one to conclude that these two very different designs could be, or

should be, combined. In fact, Ferreira teaches that the arrangement of Figs. 3-5 has many advantages over the arrangement of Figs. 1 and 2. *See col. 2 line 49-col. 3 line 21.*

In light of the foregoing, Nozawa and Ferreira, alone or in combination, do not teach or suggest the invention as recited in claim 2. As such, claim 2 is allowable.

The Examiner rejected claims 7 and 34 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Kawamata (JP 08-223832).

Claim 7 depends from claim 1 and claim 34 depends from claim 33.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1 or claim 33, much less those of claim 7 and 34.

Kawamata does not cure the deficiencies of Nozawa. Kawamata discloses a rotor for an electric motor that includes a plurality of magnets embedded in the rotor. Each magnet extends substantially radially from a point near the axis of rotation to a point near the outer surface of the rotor. However, no portion of the magnets extends continuously around the axis of rotation as recited in claims 1 and 33. Rather, there is a gap between adjacent magnets.

In light of the foregoing, Nozawa and Kawamata, alone or in combination, do not teach or suggest each and every limitation of claims 7 and 34. As such, claims 7 and 34 are allowable.

The Examiner rejected claims 8-9, 22, 24, and 35 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Cuenot (U.S. Patent No. 5,091,668).

Claims 8-9 depend from claim 1, claims 22 and 24 depend from claim 19, and claim 35 depends from claim 33.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1, claim 19, or claim 33, much less those of claims 8-9, 22, 24, and 35.

Cuenot does not cure the deficiencies of Nozawa. Cuenot discloses a motor having flux concentrating permanent magnets 4. As illustrated in Fig. 2, the permanent magnets are substantially rectangular components arranged such that their long axes are substantially radial. However, each magnet 4 is separated from adjacent magnets by laminations. As such, the permanent magnets do not include a portion that continuously surrounds the axis of rotation, as recited in claims 1 and 33. In addition, because Cuenot does not teach or suggest a permanent magnet that includes both a portion that substantially surrounds the axis of rotation and radially extending portions, Cuenot cannot possibly teach or suggest magnitudes of magnetization for these two portions that are different, as recited in claim 19.

In light of the foregoing, Nozawa and Cuenot, alone or in combination, do not teach or suggest each and every limitation of claims 8-9, 22, 24, and 35. As such, claims 8-9, 22, 24, and 35 are allowable.

The Examiner rejected claims 8, 10, 31, 35, and 39 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Noodleman (U.S. Patent No. 3,979,821).

Claims 8 and 10 depend from claim 1, claim 31 depends from claim 25, and claims 35 and 39 depend from claim 33.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1, claim 25, or claim 33, much less those of claims 8, 10, 31, 35, and 39.

Noodleman does not cure the deficiencies of Nozawa. Noodleman discloses a rotor that includes rare earth magnets positioned within slots defined by a plurality of stacked laminations. The slots and magnets are substantially rectangular such that the long axes of the rectangles are substantially radial. However, the magnets are separated from adjacent magnets such that there is no portion of magnet that extends continuously around the axis of rotation of the motor, as recited in claims 1 and 33. In addition, because Noodleman does not teach or suggest a permanent magnet that includes both a portion that substantially surrounds the axis of rotation and radially extending portions, Noodleman cannot possibly teach or suggest magnitudes of magnetization for these two portions that are different, as recited in claim 25.

In light of the foregoing, Nozawa and Noodleman, alone or in combination, do not teach or suggest each and every limitation of claims 8, 10, 31, 35, and 39. As such, claims 8, 10, 31, 35, and 39 are allowable.

The Examiner rejected claims 11, 14, 23, 29-30, and 37-38 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Nichiki (JP 06-62541).

Claims 11 and 14 depend from claim 1, claim 23 depends from claim 19, claims 29-30 depend from claim 25, and claims 37-38 depend from claim 33.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1, claim 19, claim 25, or claim 33, much less those of claims 11, 14, 23, 29-30, and 37-38.

Nichiki does not cure the deficiencies of Nozawa. Nichiki discloses a rotor that includes a shaft 22 and a magnet 21 that are integrally molded. The magnet is substantially cylindrical. As such, the magnet does not include a portion that continuously, or substantially,

surrounds the axis of rotation *and* a plurality of outwardly extending spoke portions. With regard to claims 23 and 29-30, because Nichiki does not teach or suggest a permanent magnet that includes both a portion that substantially surrounds the axis of rotation and radially extending portions, Nichiki cannot possibly teach or suggest magnitudes of magnetization for these two portions that are different, as recited in claims 19 and 25, from which claims 23 and 29-30 depend.

In addition, if the teachings of Nozawa were combined with those of Nichiki, one would not arrive at the device defined by claims 11, 14, and 37-38. Nichiki includes a magnet 21 that is positioned around the rotor, while Nozawa teaches magnets that are radially-oriented and spaced apart. Nothing in either reference suggests that combining these two different aspects would be advantageous. Furthermore, there is no suggestion as to how these two aspects would be combined. Thus, one of ordinary skill in the art when presented with the teachings of Nozawa and Nichiki would pick one of the designs over the other and would not combine them.

In light of the foregoing, Nozawa and Nichiki, alone or in combination, do not teach or suggest the invention as recited in claims 11, 14, 23, 29-30, and 37-38. As such, claims 11, 14, 23, 29-30, and 37-38 are allowable.

The Examiner rejected claims 16 and 21 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Takemoto (JP 07-203643).

Claims 16 and 21 have been cancelled, thus rendering this rejection moot.

The Examiner rejected claims 18, 22, and 26 under 35 U.S.C. §103(a) as being unpatentable over Nozawa in view of Uchida (U.S. Patent No. 5,157,297).

Claim 18 depends from claim 1, claim 22 depends from claim 19, and claim 26 depends from claim 25.

As discussed with regard to the 35 U.S.C §102(b) rejections, Nozawa does not teach or suggest each and every limitation of claim 1, claim 19, or claim 25, much less those of claims 18, 22, and 26.

Uchida does not cure the deficiencies of Nozawa. Uchida discloses a rotor that includes a shaft 12a surrounded by a resin 22. A plurality of rectangular magnets 18 extend in a substantially radial direction and are separated by a plurality of rotor core sectors 20. Uchida does not teach or suggest a magnet that includes a portion that continuously surrounds the axis of rotation *and* a plurality of outwardly extending spoke portions, as recited in claim 1.

In addition, because Uchida does not teach or suggest a permanent magnet that includes both a portion that substantially surrounds the axis of rotation and radially extending portions, Uchida cannot possibly teach or suggest magnitudes of magnetization for these two portions that are different, as recited in claims 19 and 25.

In light of the foregoing, Nozawa and Uchida, alone or in combination, do not teach or suggest each and every limitation of claims 18, 22, and 26. As such, claims 18, 22, and 26 are allowable.

CONCLUSION

In light of the foregoing, Applicants respectfully submit that claims 1-15, 17-20, 22-31, 33-39, and 42-47 are allowable.

The undersigned is available for telephone consultation during normal business hours.

Respectfully submitted,



Thomas J. Otterlee
Reg. No. 48,652

Docket No.: 010121-9939-00
Michael Best & Friedrich LLP
100 East Wisconsin Avenue
Milwaukee, Wisconsin 53202-4108

(414) 271-6560